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DECLARATION UNDER 37 C.F.R. SECTION 1.132 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	09/608,639	Confirmation No. 9272
Applicant	:	Yongquin Chen, et al.	
Filed	:	6/30/2000	
TC/A.U.	:	2819	
Examiner	:	Cornelius H. Jackson	
Docket No.	:	Chen 1-18, LS13401-1074	
Customer No.	:	28221	

DECLARATION

I, Dr. Manyalibo Matthews, declare that:

1. I have earned the following technical degrees: a Bachelor of Science in Applied Physics, from the University of California at Davis, awarded June 1993, and a Doctorate in Physics from the Massachusetts Institute of Technology (MIT), awarded June 1998. I have engaged in R&D in the fields of optical communications and optical fibers for the past 5 years. I am currently Member of the Technical Staff in the Optical Networking Research Division, Bell Labs Innovations, at Lucent Technologies, Inc.

2. The following is a representative list of my publications in the field:

"*CWDM Overlay of an EPON System: A Demonstration and Economic Ramifications for FTTH*", B. R. Eichenbaum, H. J. Thiele, L. E. Nelson, M. J. Matthews, D. T. Van Veen, NFOEC '03

"*Impurity Effect on Photoluminescence in Lateral Epitaxially Overgrown GaN*", J.W.P. Hsu, F.F. Schrey, M.J. Matthews, S. Gu, T.F. Kuech, Journal of Electronic Materials V32, 2003, p322-326

"*Gain mechanism in quantum wire lasers: a 1-D Coulomb-correlated electron-hole plasma*" submitted to Physical Review Letters, H. Akiyama, L.N. Pfeiffer, M. Yoshita, A. Pinczuk, .B.Littlewood, K.W.West, M.J. Matthews, J.Wynn, April 2, 2002

"*Carrier density imaging of lateral epitaxially overgrown GaN using scanning confocal Raman microscopy*" M.J. Matthews, J.W.P. Hsu, S. Gu, T.F. Kuech, Applied Physics Letters V79, 19, NOV 5, 2001, p3086-3088

M.J. Matthews, J.W.P. Hsu, S.L. Gu and T.F. Kuech, "*Carrier Density Imaging of Lateral Epitaxial Overgrown GaN using Scanning Confocal Raman Microscopy*", Appl. Phys. Lett. 79 3086 (2001)

J.W.P. Hsu, D.V. Lang, M.J. Matthews, S. Richter, D. Abusch-Magder, R.N. Kleinman, S.L. Gu and T.F. Kuech, "*Spatial Variation of Electrical Properties in Lateral Epitaxial Overgrown GaN*", Appl. Phys. Lett. 79 761 (2001)

M.J. Matthews, A.L. Harris, A.J. Bruce and M.J. Cardillo, "*Characterization of Phosphosilicate Thin Films Using Confocal Raman Microscopy*", Rev. Sci. Instr. 71, 2117 (2000)

3. The rejection of patent application 09/608,639 was in large part based on a misunderstanding of the physics involved with fiber Bragg grating (FBG)-based external cavity lasers, such as the one in the present application and Verdiell U.S. Patent No. 5,870,417. As discussed in both documents (09/608,639 and 5,870,417), one of the key problems preventing the stable operation of single-longitudinal mode (SLM) external cavity lasers is that of longitudinal mode hopping. Mode hopping is caused by a re-distribution of optical power among the oscillating modes that can arise from changes in cavity gain or loss as a function of wavelength (see for example Alalusi et al., IEEE J. Quantum Electronics 31 (1995) 1181). Changes in case temperature, injection current, and modulation depth can also induce mode hops in longitudinal-mode locked external cavity lasers.

4. Typically, external cavity lasers are favored over 'internal' cavity lasers because of the added freedom to 'tune' or select a single longitudinal mode. In a simple internal cavity laser such as the cleaved-facet Fabry-Perot, no selection of modes is possible (the difference in gain between modes is smaller than the inherent noise fluctuations in the cavity and the free spectral range is much less than the width of the gain spectrum) and a multi-longitudinal mode (MLM) output is observed. It should be noted that, although optical power is continually shared and can in some sense be considered continuous non-exclusive mode hopping between all modes, the effect of mode hopping in FP lasers does not limit their performance while it in fact severely limits the performance of SLM lasers.

5. For example, in Fig. 9 of Verdiell, the typical optical output of an external cavity laser versus temperature is drawn for reference. This figure shows that, due to changes in the wavelength overlap of end facet reflectivities and all the allowable cavity modes (see for example the generic diagram of Fig.5 of Verdiell), the wavelength of the laser output will 'jump' when the active mode overlaps less than another non-active mode. The picture and accompanying text (col.8, lines 3-32), in fact, describe mode hops in an external cavity laser operating in a SLM and not operating with multi-longitudinal modes simultaneously. It is well known that the result of such mode hops is a fluctuation laser output intensity that causes so-called 'burst errors' in directly-modulated communication lasers. The approach of Verdiell to solve this particular problem is to increase the free spectral range of the allowable cavity modes so that as temperature changes and the overlap shown in Fig.5 moves, only one mode ever overlaps with the end facet reflectivities (i.e. the FBG). This is described in col.8 lines 62-65. This approach is equivalent to limiting operation of the laser to one of the saw tooths shown in Fig.9. The only other considerations given to solving this problem are packaging designs (see discussion in Cols.9 and 10). Other approaches for maintaining

single mode operation can be found in Mattori et al., IEICE Trans. Elec. Dev. E85-C (2002) 98.

6. However, it was discovered by the inventors at Bell Labs that mode hop noise does not arise if the laser is designed to specifically allow 2-3 modes to operate *simultaneously*. By allowing more than one mode (i.e. engineering the free spectral range of the cavity to be *less* than the FBG bandwidth), optical power generated by the gain section is continuously shared and noise due to mode hops among the group of modes is drastically decreased. Only in the case of a single dominant mode will a mode hop occur causing a burst of optical noise. In fact, the Bell Labs laser is truly a multi-longitudinal mode laser whereas Verdiell's laser is explicitly – and by design – a single-longitudinal mode laser.

7. All statements made herein and in the application of my own knowledge are true and all statements made on information and belief are believed to be true; all statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of the application or any registration resulting therefrom.

Date: October 6, 2003

By: ______________________

Dr. Manyalibo Matthews,
Member of the Technical Staff,
Bell Labs Innovations, Lucent Technologies, Inc.